

SIMULATION OF DISTRIBUTED POWER FLOW CONTROLLER FACTS DEVICE IN VOLTAGE SAG AND SWELL MITIGATION

RONAK GANDHI¹, GAJENDRA PATEL² & HARSHKUMAR SHARMA³

^{1,3} PG Scholar, Electrical Department, SPCE, Visnagar, Gujarat, India

² Assistant Professor, Electrical Department, SPCE, Visnagar, Gujarat, India

ABSTRACT

In present days power system having a power quality problem due to increasing of using large number of non-linearload. Good power quality means the power supply which can always available within voltage and frequency tolerance and also these are harmonic free and pure sinusoidal shape. This paper mainly contains voltage sag and swell mitigation using Flexible AC Transmission System (FACTS) device, called Distributed Power Flow Controller (DPFC). DPFC consist of the two converter called shunt converter and series converter. Working of DPFC is as same as UPFC but there is elimination of dc link between series and shunt converter. So active power is exchange between shunt and series converter through transmission line. In DPFC shunt converter is connected to grid and series converter connected in each phase so it can control each phase individually

KEYWORDS: Flexible AC Transmission System (FACTS) and Distributed Power Flow Controller (DPFC)

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INTRODUCTION

Power quality as the ability of a system or an equipment to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment. Power quality is the combination of voltage quality and current quality. This power quality is concerned with deviations of voltage and/or current from the ideal. The major types of power quality problems are, interruption, voltage sag. Voltage swell, transients, waveforms distortion, harmonics, etc. These are different ways to control of problems for the system but most popular and simple solution is we can add an external device and installed in the given system. The different devices which are used given as shunt and series reactance, SVC, STATCOM, UPQC, UPFC, IPFC, DPFC, DIPFC, etc. The FACTS is concept based on power electronic controllers, which enhancement the value of transmission network by increases the use of their capacity. FACTS devices makes the ac transmission network flexible to adopt to the changing condition caused by contingencies and load variation.

Voltage Sag

Decreasing of RMS value of AC input voltage waveform for few second from few cycle is known as a voltage sag. Voltage sags is the short duration reduction in R.M.S voltage caused by short duration increases of the current. Voltage sag is caused by overloading, short circuit etc. The most common causes of the over current leading to voltage sags are motor starting, transformer energizing and faults. Voltage sag is mostly affect to the sensitive equipment and protection equipment typical example of voltage sag is shown in figure 1

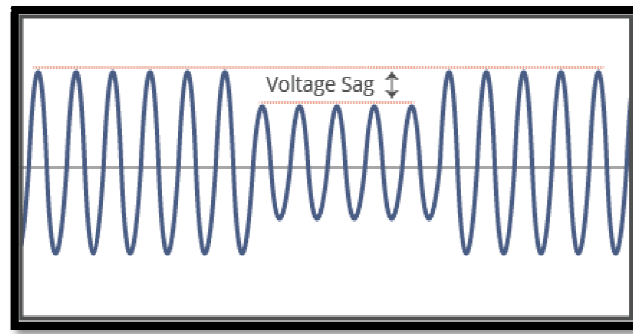


Figure 1: Voltage Sag Condition

Voltage Swell

A swell is the reverse form of Sag, increasing of RMS value of AC input voltage waveform for few second from few cycle is known as a voltage swell. Voltage swell is an RMS increases in the ac voltage, at related power frequency, for duration from 1/2 cycle to few seconds. Voltage swells will normally cause damage to lighting, motor and electronic loads and will also cause shutdown to the equipment.

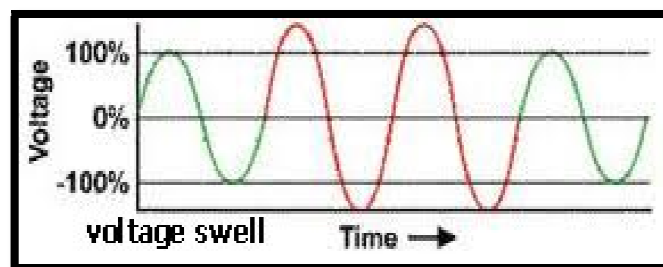


Figure 2: Voltage Swell Condition

DPFC Working

DPFC is consist of two converter 1) series and 2) shunt. Shunt converter is connected with the grid and series converter is connected to each phase of transmission line.

To detect and determination SRF method is used.

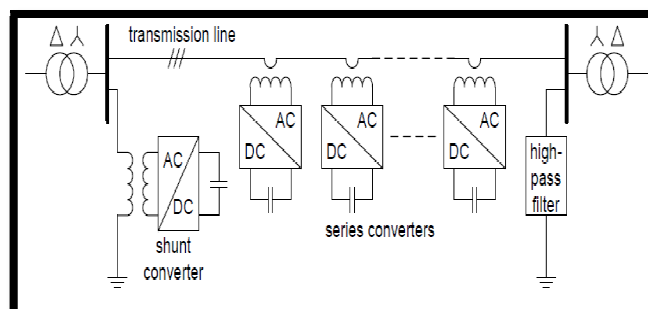


Figure 3: DPFC Configuration

By applying this method to the DPFC, shunt converter absorbs Active power from the 3 phase supply at fundamental and inject the active power to the transmission line at 3rd harmonics frequency. Series converter generate the voltage single according to the 3r harmonics active power and absorbs it. Then it generates the active power at fundamental

frequency to the transmission line and it given to the load.

SIMULATION & RESULTS

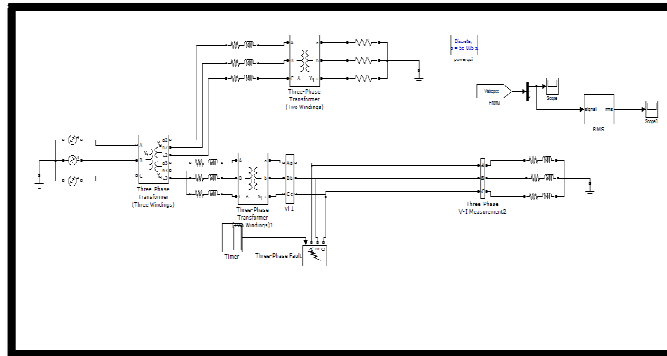


Figure 4: Voltage Sag Condition in 3-Phase System

As shown above in figure 4 there is 3-phase fault is created in the three phase system which creates voltage sag problem in this system. The three phase fault is operated and controlled through external timer signal which is also shown in the figure. The simulation results of voltage sag condition are shown below:-

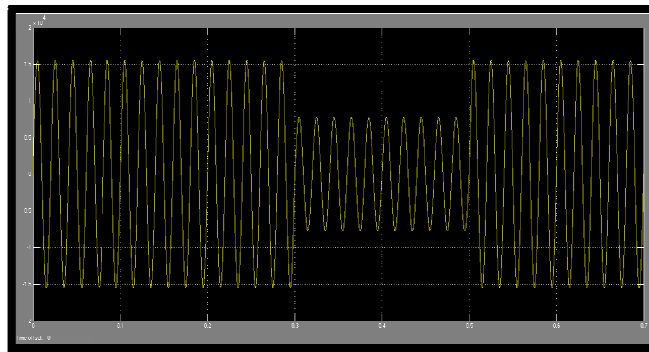


Figure 5: Voltage Sag Condition

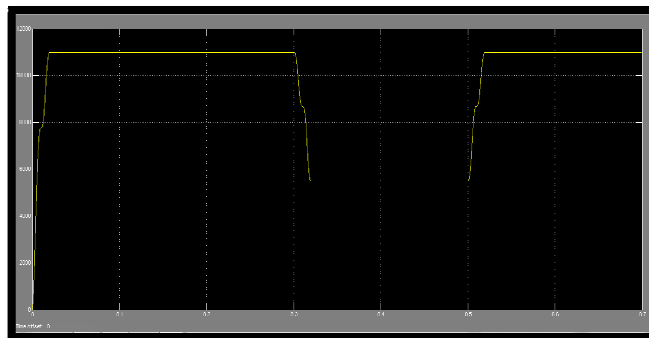


Figure 6: Voltage Sag R.M.S Value

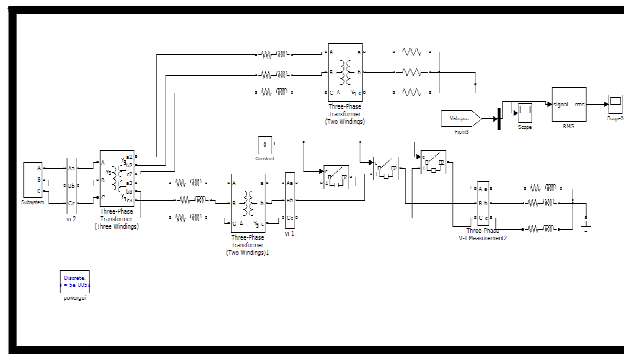


Figure 7: Voltage Swell Condition in 3-Phase System

Now as shown below in figure 8 there is delay will be provided using external timer signal in the three phase system which creates voltage swell problem in this system. The three phase power supply is operated and controlled through external timer signal which is also shown in the figure. The simulation results of voltage sag condition are shown below:-

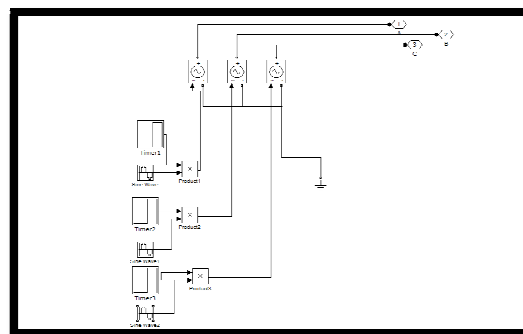


Figure 8: Three Phase Power Supply with External Timer Signal Control

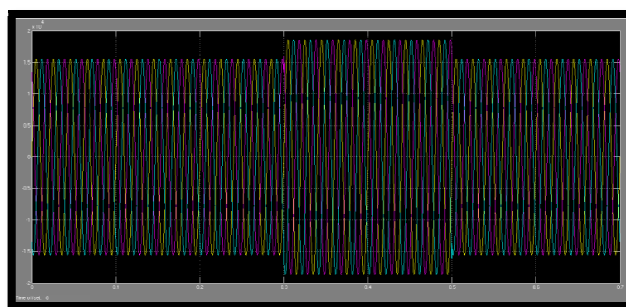


Figure 9: Voltage Swell Condition

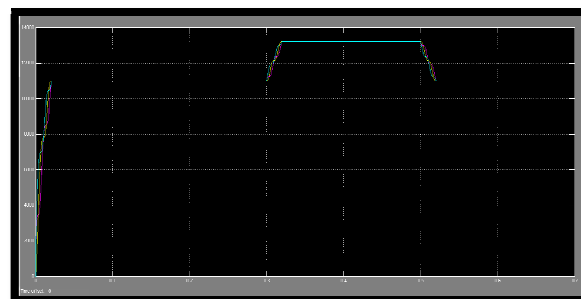


Figure 10: Voltage Sag R.M.S Value

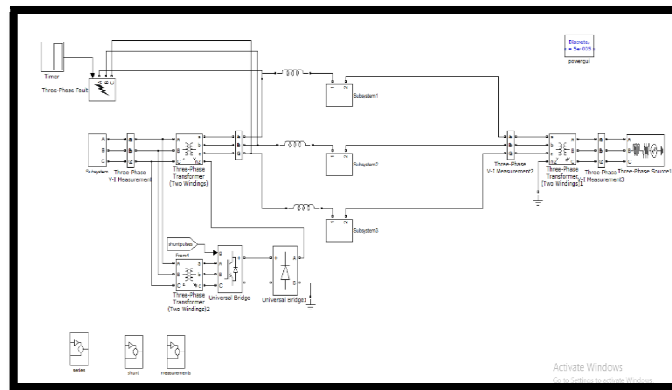


Figure 11: Voltage Sag Mitigation using DPFC in 3 Phase System

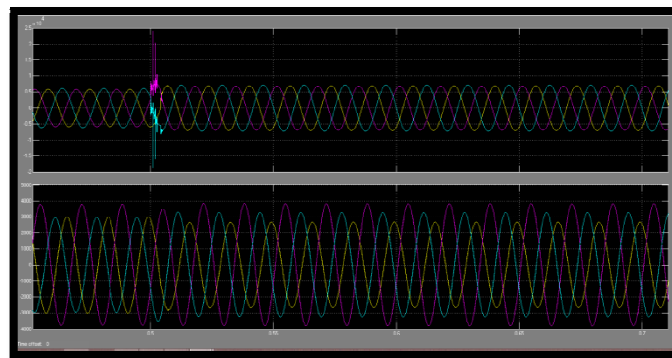


Figure 12: Voltage and Current Waveform after Using DPFC

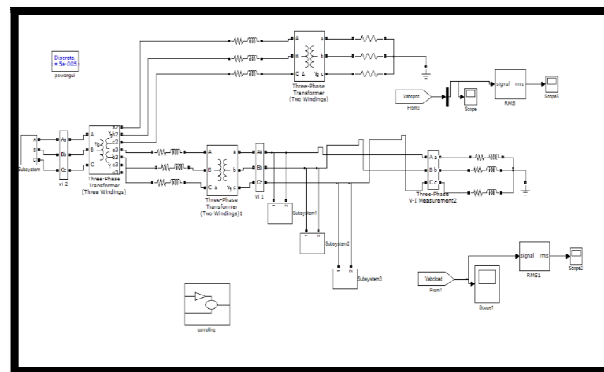


Figure 13: Voltage Swell Mitigation Using DPFC

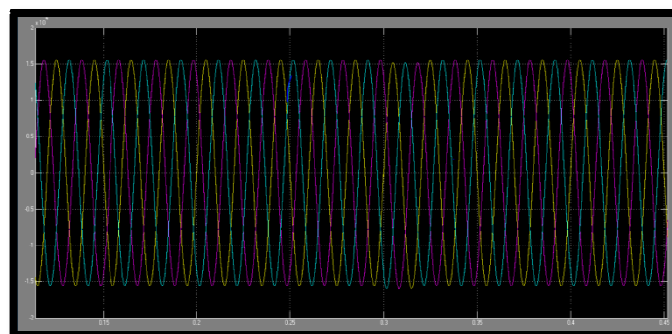


Figure 14: Voltage Waveform after Using DPFC

CONCLUSIONS

The power quality is vanished due to large amount of use of nonlinear load now a days. If power quality is vanished then it will affected to power system a lot so it is necessary to mitigate this problem. In this paper voltage sag and swell problem is solved by using DPFC is shown. The obtained simulation results shows the voltage sag and swell condition. We can mitigate the voltage sag and swell problem using DPFC device.

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